

REMARKS

Claims 1-4, 8, 9, 11, 13-17, and 20-29 are pending, including independent claims 1, 8, 13, 17, 22 and 26. The claims were again rejected over the same prior art as before. However, Applicants continue to disagree with the Examiner's application of the prior art.

Applicants' invention generally relates to a noise reduction circuit comprising two directional microphones that are positioned close together but with different orientations relative to a speaker's vocalizing direction. An adaptive filter simulates a noise signal outputted from a primary microphone by using a noise signal outputted from the other microphone, and subtracts the simulated noise signal from the output of the primary microphone. More specifically, Applicants' invention relates to the optimization of such a noise reduction circuit, including improvements in the placement and orientation of the microphones, and in the specific circuitry itself. The various claims specifically recite the optimized configurations discovered by Applicants, which configurations are not described or suggested in the cited art.

Claim 1 was rejected under 35 U.S.C. § 103(a) as obvious over Sasaki and Andrea. Applicants disagree.

Claim 1 recites, inter alia, that both of the two directional microphones are positioned in front of and above the position of the speaker's mouth by approximately the same distance, and that the orientation of one microphone with respect to the vocalizing direction is approximately 0° while the orientation of the second microphone with respect to the vocalizing direction is approximately 45°.

Moreover, the claim further recites that a signal from the first microphone (with 0° orientation) is supplied to a subtracter through a target response setter having a delay characteristic; a signal from the second microphone (with 45° orientation) is supplied through an adaptive filter to the subtracter; and the output of the subtracter produces a difference signal that is supplied to the adaptive filter which executes adaptive signal processing on the basis of the LMS algorithm so as to minimize the power of the difference signal.

Thus, claim 1 recites a specific circuit and arrangement of directional microphones, as well as specific connections between the circuit and the two directional microphones. Support is found in the application at, e.g., Figs. 1, 3(a) and 4; p. 8, line 15 to p. 10, line 3; p. 11, lines 9-20. Through experimentation described at p. 12, lines 12-31, Applicants found that the claimed configuration is particularly beneficial to obtain an improved average SN ratio.

Nothing in Sasaki describes or suggests this specific configuration. In addition, Applicants disagree with the Examiner's supposition that placing both microphones in front of and above the position of the speaker's mouth by approximately the same distance would have been obvious from Sasaki. Sasaki nowhere suggests this specific placement of microphones.

The Examiner agrees Sasaki does not teach that the angles formed by the orientations of the two microphones with respect to the speaker's vocalizing direction are approximately 0° and 45° , but states that Andrea teaches this in Fig. 3B. This is not correct. Fig. 3B depicts the receiver portion 42 of a telephone handset (see, e.g., Fig. 1; col. 12, lines 33-38). Contrary to the Examiner's assertion, microphone 12 is not set to about 0° with respect to the speaker's vocalizing direction, but rather is intentionally set at a significant angle to the "direction of speech" in Fig. 3B. Andrea teaches that θ in Fig. 3B is preferably less than about 35° (col. 14, lines 20-22), so that the microphone 12 is set at more than about 55° with respect to the direction of speech (i.e., $(90 - \theta)$). Similarly, the microphone 14 is not set at about 45° relative to the direction of speech, but rather is at an angle much more than that (see Fig. 3B, $(90 - \theta) + \phi$).

The Examiner also is incorrect to say Andrea teaches that both microphones are positioned in front of and above the position of the speaker's mouth by about the same distance. The receiver 42 of the telephone handset in Figs. 1 and 3B is positioned below the speaker's mouth (e.g., see "direction of speech" in Fig. 3B). Similarly, Fig. 9C incorporates Andrea's noise reduction device in a boom headset assembly wherein the microphones 300 and 302 are again at the speaker's mouth and not above it (see Figs. 9A-9C; col. 19, line 65 - col. 20, line 7; col. 26, lines 21-37).

Finally, Applicants note that there is no suggestion or motivation to combine Sasaki and Andrea in any reasonable way. Quite the opposite, Andrea's noise reduction apparatus is an open loop system (see Fig. 2), which Andrea states is an important distinction over conventional closed-loop apparatus (col. 8, lines 51-53), like Sasaki, so that Andrea teaches away from such a combination.

Claim 2 is rejected as obvious over Sasaki and Andrea, and further in view of Miwa. Sasaki and Andrea are deficient as described above for claim 1, and Miwa does not cure those deficiencies. Moreover, the subject matter of Miwa is not applicable to Applicants' invention. Miwa describes a sun visor that includes a docking station and charging circuit for a cellular phone and has nothing to do with the microphone and circuit configuration of Applicants' claimed invention. There is simply no reason or suggestion to combine Miwa with the noise reduction systems of either Sasaki or Andrea.

Claims 3 and 4 are rejected as obvious over Sasaki and Andrea, and further in view of Romesburg. Sasaki and Andrea are deficient as described above, and Romesburg does not cure those deficiencies. Moreover, Romesburg is contrary to Applicants' claimed invention. Claim 3 recites that both microphones (which are "positioned relatively close to one another") are mounted on the ceiling above the driver's seat, whereas claim 4 recites that both microphones are mounted on the ceiling above the front passenger seat. However, the citation in Romesburg (Fig. 8, items 22, 36) illustrates the microphones "positioned on opposite upper corners of the windshield" (col. 14, lines 32-38) which is contrary to Applicants' claimed invention.

Claims 8, 11-12, 21-22, and 26 are rejected as obvious over Sasaki in view of Andrea and Miura.

Claim 8 is directed to a variation of the first embodiment and recites, *inter alia*, that two directional microphones are spaced apart approximately 9 cm, and the orientation of one microphone with respect to the vocalizing direction is approximately 0° while the orientation of the second microphone with respect to the vocalizing direction is approximately 60°. Claim 8 also recites (as in claim 1) that the microphones are positioned in front of and above the position of the speaker's mouth by

approximately the same distance, and recites the same specific circuit and connections to the two directional microphones as in claim 1.

Thus, claim 8 also recites a specific circuit and arrangement of directional microphones. Support is found in the application at, e.g., Figs. 1, 3(a) and 5; p. 8, line 15 to p. 10, line 3; p. 11, lines 9-17, 22-24. Through experimentation described at p. 13, lines 1-8, Applicants found that this claimed configuration also is particularly beneficial to obtain an improved average SN ratio.

For the reasons explained above in connection with claim 1, neither Sasaki nor Andrea describes or suggests this particular beneficial microphone configuration and circuit arrangement. Moreover, Miura does not teach that the two microphones are spaced apart approximately 9 cm as the Examiner asserts. The English translation of Miura only identifies a distance of 5 cm. Further, the spacing in Miura appears to be in the direction of the sound source, whereas the 9 cm spacing in claim 8 is a lateral spacing (because both microphones are positioned in front of and above the position of the speaker's mouth by about the same distance -- see Figs. 3(a), 5 of the application).

Dependent claim 11 is patentable for at least the reasons explained for claim 8.

Dependent claim 12 previously was cancelled, so that the rejection is moot.

Claim 21, dependent on claim 1, adds that the distance between the two microphones is about 9 cm and distinguishes over Miura as explained above.

Independent claim 22 is directed to a variation of the first embodiment and recites, *inter alia*, that two directional microphones are oriented substantially perpendicularly to the speaker's vocalizing direction and are spaced apart approximately 7.5 cm. Claim 22 also recites that the microphones are positioned above and to one side of the position of the speaker's mouth by approximately the same distance and are spaced apart from one another in the vocalizing direction, and also recites the same specific circuit and connections to the two directional microphones as in claim 1.

Thus, claim 22 also recites a specific circuit and arrangement of directional microphones. Support is found in the application at Figs. 1, 3(b) and 6; p. 8, line 15 to p. 10, line 3; p. 11, line 25 to p. 12, line 5; p. 12, lines 12-25; p. 13, lines 9-15. Through

experimentation described at p. 13, lines 9-15, Applicants found that this claimed configuration also is particularly beneficial to obtain an improved average SN ratio.

As in the case of claims 1 and 8 discussed above, neither Sasaki nor Andrea describes or suggests this particular beneficial configuration, including two directional microphones oriented substantially *perpendicularly* to the vocalizing direction, at approximately the *same distance above and to one side* of the speaker's mouth, and spaced apart *approximately 7.5 cm in the vocalizing direction*, as well as the particular circuit arrangement and how it connects to the two differently positioned microphones.

There is no basis for the Examiner's hypothetical that the microphones in Andrea's telephone handset can be positioned perpendicular to the speaker's vocalizing direction by rotating the handset far upwards or downwards. Andrea does not suggest this artificial situation or that the system would even operate properly in such a situation. To the contrary, Andrea states that the receiver should be positioned very close to the speaker's mouth (e.g., col. 14, lines 2-6; col. 26, lines 21-37), i.e., not rotated away from the speaker's mouth as the Examiner suggests. Moreover, Miura does not teach a microphone spacing of approximately 7.5 cm as claimed. The English translation of Miura only identifies a distance of 5 cm.

Claim 26 is directed to a variation of Applicants' invention and recites, inter alia, that one directional microphone is oriented substantially perpendicularly to the vocalizing direction, the other directional microphone is oriented at an acute angle relative to the orientation of the first microphone, and the two microphones are spaced apart by about 2 cm. Claim 26 also recites that the microphones are positioned above and to one side of the position of the speaker's mouth by approximately the same distance and are spaced apart from one another in the vocalizing direction, and also recites the same specific circuit and connections to the two directional microphones as in claim 1.

Thus, independent claim 26 also recites a specific circuit and arrangement of directional microphones. Support is found in the application at Figs. 1, 3(b), 7; p. 8, line 15 to p. 10, line 3; p. 11, line 25 to p. 12, line 2 and lines 6-11; p. 13, lines 16-27. Through experimentation described at p. 12, lines 13-25; p. 13, lines 16-27, Applicants

found that this claimed configuration also is particularly beneficial to obtain an improved average SN ratio.

In the same way as explained above, Sasaki and Andrea do not describe or suggest this particular beneficial configuration. The cited passages of Sasaki and Andrea do *not* describe or suggest orienting a directional microphone substantially perpendicularly to a vocalizing direction, orienting a second microphone at an acute angle relative to the orientation of that first microphone, positioning both microphones above and to one side of the position of the speaker's mouth by approximately the same distance, and spacing apart the two microphones in the vocalizing direction by about 2 cm specifically, as well as the particular circuit arrangement and how it connects to the two differently positioned microphones. The cited passage of Sasaki also does not suggest a specific microphone spacing of about 2 cm; in fact no specific spacing is identified.

Claims 9, 23 and 27 are rejected as obvious over Sasaki, Andrea and Miura, and further in view of Miwa. These dependent claims recite that the microphones are mounted on the sun visor of a vehicle. For at least the reasons discussed above in connection with claim 2, the cited art is not applicable and does not suggest this feature.

Claim 13 is rejected as obvious over Hosoi and Romesburg. Applicants disagree. Claim 13 is directed to the embodiment shown in Fig. 8 of the present application and is supported at, e.g., p. 14, lines 1-10. This claim recites, *inter alia*, that a first adaptive signal processor receives "an error signal" as one input; a second adaptive signal processor receives "said error signal" (i.e., the same error signal received by the first signal processor) as one input; the two signal processors provide output signals to the same subtracter which in turn outputs "said error signal;" and the signal processors operate to minimize the power of "said error signal." These features simply are not shown in Fig. 3 of Hosoi. Specifically, filters 13 and 14 receive *different* error signals 104 and 105, not the same error signal, and the filters 13 and 14 provide outputs to *different* adders 15 and 16 that produce the two error signals, not the same subtracter. Therefore, Hosoi clearly is not applicable to claim 13, and Romesburg does not cure these deficiencies.

Dependent claim 14 is rejected as obvious over Hosoi and Romesburg, and further in view of Walters. As described for claim 13, however, the combination of Hosoi and Romesburg is inapplicable. In addition, and contrary to the Examiner's assertion, Fig. 2 in Romesburg does not teach a microphone disposed almost directly above the face of a speaker as the Examiner asserts. If anything, the microphone 22 is shown in front of and slightly below the speaker's face.

Dependent claims 15 and 16 are rejected as obvious over Hosoi, Romesburg and Walters, and further in view of Lange and Miura. As explained above in connection with claim 13, however, Hosoi and Romesburg do not affect the patentability of these claims. Moreover, Lange does not cure the deficiencies of that art. The Examiner agrees that Lange does not teach a microphone spacing of about 1 to 5 cm, but takes "official notice" that various distances in a microphone array are well known. However, Applicants are not simply claiming a microphone spacing per se. Rather, the claims recite a specific circuit and a specific placement of microphones, and this subject matter is not suggested by any reasonable combination of the cited references.

Claim 17 is rejected as obvious over Sasaki and Lange. This claim recites that one microphone is positioned at a height substantially directly above a speaker's face and the other microphone is spaced to the rear (occipital side) by about 1 cm to 5 cm, and also recites the same specific circuit and connections to the two directional microphones as in claim 1.

Thus, claim 17 also recites a specific circuit and arrangement of directional microphones. Support is found in the application at Figs. 9, 11-14; p. 14, line 13 to p. 15, line 6; p. 17, line 9-p. 18, line 5. Through experimentation described at p. 17, line 9 to p. 18, line 5, Applicants found that this claimed configuration also is particularly beneficial to obtain an improved average SN ratio.

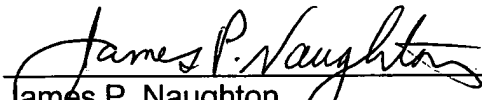
Sasaki is not applicable as explained above. Moreover, Lange does not show or suggest one microphone disposed almost directly above the face of a speaker as the Examiner asserts, or that another microphone is specifically spaced apart from that first microphone on the occipital side by about 1 to 5 cm. The microphones 1a in Fig. 1 of Lange are in front of and behind the person, but not "almost directly above" the face of a speaker.

Dependent claim 20 is rejected as obvious over Sasaki and Lange, and further in view of Yoshida. As explained above for claim 17, Sasaki and Lange are not applicable. In addition, the passage in Yoshida that is cited by the Examiner (col. 8, line 30 to col. 9, line 6) relates to a power-monitoring circuit in Fig. 5. Applicants do not see any relation between the cited passage and the subject matter of claim 20.

Dependent claims 24 and 25 and dependent claims 28 and 29 are rejected as obvious over Sasaki, Andrea and Miura, and further in view of Romesburg. These claims correspond to claims 3 and 4, however, and are patentable over the cited art as explained above.

In summary, Applicants submit that the pending claims are directed to specific microphone configurations that are connected to specific circuit arrangements in specific ways, and are patentable over the cited art. Accordingly, Applicants respectfully request reconsideration and allowance of this application.

Respectfully submitted,


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